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**NORTH ATLANTIC TREATY ORGANIZATION
ORGANISATION DU TRAITE DE L'ATLANTIQUE NORD**

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MAS(AIR)314-AA/3786
19 October 1994

To : See Distribution List Air B

Subject : STANAG 3786 AA (EDITION 4) - SAFETY DESIGN
REQUIREMENTS FOR AIRBORNE DISPENSER WEAPONS

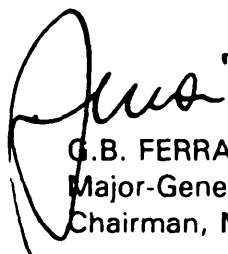
References : a. MAS(AIR)329-AA/3786 dated 30 July 1992 (Edition 3)
b. MAS(AIR)483-AA/3786 dated 15 November 1993
(Edition 4)(1st Draft)

Enclosure : STANAG 3786 (Edition 4)

1. The enclosed NATO Standardization Agreement which has been ratified by nations as reflected in page iii is promulgated herewith.
2. The references listed above are to be destroyed in accordance with local document destruction procedures.
3. AAP-4 should be amended to reflect the latest status of the STANAG.

ACTION BY NATIONAL STAFFS

4. National staffs are requested to examine page iii of the STANAG and if they have not already done so, to advise the Air Board, MAS, through their national delegation as appropriate of their intention regarding its ratification and implementation.



G.B. FERRARI
Major-General, ITAF
Chairman, MAS

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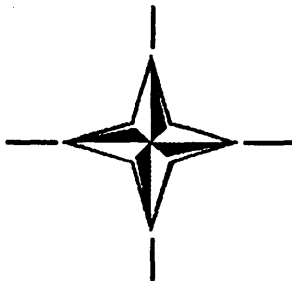
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STANAG No. 3786
(Edition 4)

**NORTH ATLANTIC TREATY ORGANIZATION
(NATO)**



**MILITARY AGENCY FOR STANDARDIZATION
(MAS)**

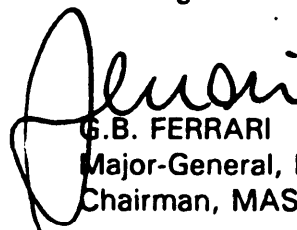
**STANDARDIZATION AGREEMENT
(STANAG)**

SUBJECT: SAFETY DESIGN REQUIREMENTS FOR AIRBORNE DISPENSER
WEAPONS

DISTRIBUTION STATEMENT C

Distribution authorized to U.S. Government agencies and their contractors for administrative or operational use. Other requests for this document shall be referred to HQ USAF/XOXX(ISO)

Promulgated on 19 October 1994



G.B. FERRARI
Major-General, ITAF
Chairman, MAS

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RECORD OF AMENDMENTS

No.	Reference/date of amendment	Date entered	Signature

EXPLANATORY NOTES

AGREEMENT

1. This NATO Standardization Agreement (STANAG) is promulgated by the Chairman MAS under the authority vested in him by the NATO Military Committee.
2. No departure may be made from the agreement without consultation with the tasking authority. Nations may propose changes at any time to the tasking authority where they will be processed in the same manner as the original agreement.
3. Ratifying nations have agreed that national orders, manuals and instructions implementing this STANAG will include a reference to the STANAG number for purposes of identification.

DEFINITIONS

4. Ratification is "The declaration by which a nation formally accepts the content of this Standardization Agreement".
5. Implementation is "The fulfilment by a nation of its obligations under this Standardization Agreement".
6. Reservation is "The stated qualification by a nation which describes that part of this Standardization Agreement which it cannot implement or can implement only with limitations".

RATIFICATION, IMPLEMENTATION AND RESERVATIONS

7. Page iii gives the details of ratification and implementation of this agreement. If no details are shown it signifies that the nation has not yet notified the tasking authority of its intentions. Page iv (and subsequent) gives details of reservations and proprietary rights that have been stated.

Agreed English/French texts

STANAG 3786
(Edition 4)

NAVY/ARMY/AIR

NATO STANDARDIZATION AGREEMENT
(STANAG)

SAFETY DESIGN REQUIREMENTS FOR AIRBORNE
DISPENSER WEAPONS

Annexes: A. General Safety Design Requirements Guidance for
Airborne Dispenser Weapons

Related Documents: STANAG 3525 AA - SAFETY DESIGN REQUIREMENTS -
AIRBORNE FUZING SYSTEMS
STANAG 3441 AA - DESIGN OF AIRCRAFT STORES
STANAG 4170 MMS - PRINCIPLES AND METHODOLOGY
FOR THE QUALIFICATION OF
EXPLOSIVE MATERIALS FOR
MILITARY USE
AOP-15 - GUIDANCE ON THE ASSESSMENT
OF THE SAFETY AND
SUITABILITY FOR SERVICE OF
MUNITIONS FOR NATO ARMED
FORCES

AIM

1. The aim of this agreement is to standardize the safety design requirements for airborne dispenser weapons (dispenser and associated submunitions) both captive and free flight.

AGREEMENT

2. Participating nations agree to design airborne dispenser weapons in accordance with the requirements of this STANAG. This agreement is applicable to the development of dispenser weapons initiated after ratification.

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DETAILS OF THE AGREEMENT

3. The Need for Safety Design Requirements. In addition to the hazard concerned with detonation of the dispenser submunition, the overall potential hazard associated with airborne dispenser weapons must be considered. The inadvertent, premature or incorrect operation of airborne dispenser weapons, both captive and free flight, could result in a hazard to the safety of personnel, carriage aircraft and equipment. To ensure that adequate and uniform standards of safety are achieved and maintained, there is a need to define and standardize the Safety Design Requirements for Airborne Dispenser Weapons, to be observed by designers.

4. Safety Design Requirements for Airborne Dispenser Weapons. The following requirements shall be adhered to unless any deviation from them has been justified to, and accepted by, the appropriate safety authorities and documented for reference by other participants.

5. Fuzing. The dispenser weapon fuzing system (i.e., the dispenser weapon fuze, submunition cluster fuze and submunition fuze) shall meet the Design Safety Principles stated in STANAG 3525. Where a dispenser weapon, submunition cluster, or submunition employs devices to initiate various events and inadvertent operation of these devices could result in a hazard, the system(s) controlling these devices shall meet the applicable Design Safety Principles stated in STANAG 3525.

6. Structural Strength. The weapon shall be designed to have the structural strength to withstand the natural and induced environments to which it may be subjected in the manufacture-to-target sequence defined in the requirements specification.

7. Materials. All materials, particularly explosives, sealants and adhesives, should be mutually compatible. Where it is necessary to use incompatible materials, they shall be separated by a mutually compatible and environmentally sealed barrier. The effect of natural and induced environments experienced during the specified conditions of storage and use shall not give rise to a hazardous condition or to the formation of sensitive or dangerous substances.

8. Qualification of Explosive Compositions. Explosive compositions used in the system shall be qualified to the requirements of STANAG 4170.

9. Manual Operations. Facilities for manual operation shall not be included unless the requirements of paragraph 18b cannot be met in which case the design shall provide the maximum feasible protection against human error. The means of achieving this shall include limiting access to critical points in the system, limiting the extent of manual operations to those which are absolutely essential and ensuring that the actions required are simple and positive. Depending upon the circumstances one or more of the following shall apply:

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a. Safety and Arming Plugs. If a safety plug is incorporated in a dispenser weapon design, it shall interrupt all critical ejection command lines. The safety plug and the arming plug shall be distinctive in appearance (i.e. have a red cloth/plastic flag attached to them) so as to eliminate the chance of error.

b. Safety and Arming Switches. If externally-operated manual safety and arming switches are incorporated in dispenser weapon designs, the following criteria shall apply:

(1) The design of the switches shall be such that their condition can readily be seen without the aid of any test equipment.

(2) To protect against inadvertent actuation or setting, switches shall be used that require at least two distinct manual actions for operation (e.g., push before turn, unlock before operation).

(3) When a removable pin is used to control a safety and arming switch, then operation of the switch shall require complete withdrawal of the pin from the dispenser; there shall be no intermediate position where the state of the switch is uncertain. Such removable pins shall be readily identifiable and shall incorporate features that make them unique to the safety and arming switch. It shall be possible to replace the pin to resafe the switch.

c. Weapon Controls and Circuits. Weapon controls and circuits shall be designed to prevent firing when an improper control operation or improper operating sequence is undertaken. When practicable, designs shall ensure that it is mechanically or electrically impossible to actuate control circuits in improper sequence. Sequential dependent functions can provide safety by being interlocked. If software is to be used in the weapon control system, a formal structured design approach shall be adopted due to the need for demonstrable high reliability, maintainability and efficiency.

10. Electrical Connectors. Electrical connectors shall be designed or selected to prevent improper mating of connectors. Each system shall be analyzed to ensure that it does not contain connectors with similar keys or contact arrays at locations in the assembly where they may be mated or interchanged. Pin arrangements should not be used as the only method to prevent mismatching or misindexing of connectors. Designs shall provide for maximum protection against electrical faults due to presence of moisture or extraneous material trapped in connectors. The design of connectors shall be such that, on mating, the shielding connection is made first and is last to be disconnected.

11. Delivery Aircraft Safety. Dispensers, weapons, and/or their submunitions shall be capable of safe carriage, release or jettison from the carriage aircraft throughout the applicable portions of the flight envelope as defined in the weapon requirement specification. Safety of the delivery aircraft after weapon release or submunition release from captive dispensers shall be provided by ensuring that the weapon or submunition remains safe for a specified distance of travel, or other parameter consistent with each type of function.

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12. Free-Flight Dispenser Weapons. The fuzing system for a free-flight dispenser weapon shall ensure that:

- a. Arming and functioning of the dispenser and submunitions are delayed to provide a safe-separation distance between aircraft and weapon.
- b. The dispenser weapon can be jettisoned with all elements of the fuzing system in a safe condition.

13. Captive Dispenser Weapons. Where the aircraft electrical supply is required to power dispenser functions it shall not be made available in the dispenser until as late in the operating sequence as possible. Termination of the power prior to actual release shall return the weapon system to a safe and serviceable condition. A captive dispenser weapon shall be enabled to commence the dispenser sequence only in response to a command signal from the carriage aircraft. The signal or signals shall possess characteristics not present in other electrical sources either internal or external to the captive dispenser weapon. Where a captive dispenser weapon includes the capability of terminating the dispensing of submunitions at any time in the sequence, such termination shall restore the dispenser to a safe condition.

a. The operating system of a captive dispenser weapon shall contain safety devices and interlocks to prevent:

(1) Inadvertent, multiple simultaneous and/or out of sequence ejection of submunitions, dispenser debris, etc.

(2) Ejection of submunitions or dispenser debris into an unsuitable environment, e.g., outside safe dispense envelope.

b. The dispensers shall be provided with ground safety devices to disable firing circuits. These shall be easily accessible and identifiable and shall meet the requirements of subparagraphs 9a and 9b, as applicable.

c. For the purposes of this STANAG, it is assumed that the initiation of all dispenser functions, including jettison, is controlled through the aircraft armament electrical system which shall ensure that:

(1) Electrical power required for jettison of the dispenser is made available only at take-off either by operation of a manual switch under the control of the pilot or by an environmentally-controlled switch, (e.g., wheels off ground).

(2) Electrical power to function the dispenser is made available only after a switch (e.g., late arm switch) additional to that above is operated by the pilot prior to the attack.

d. The dispenser/aircraft electrical interface and dispenser electrical design shall be compatible with the aircraft armament electrical system thus:

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(1) The allocation of connector contacts or terminal block contacts shall be such that standing supplies (Note 1) are separated from safety critical lines (e.g., initiate, release, firing and jettison lines) by at least one contact space. Connector contacts surrounding those used for safety critical circuits shall be spare contacts that form an isolating barrier or earth (ground) or contacts that are used for circuit earthing (grounding), bonding or screening. Care shall be taken in the design of the system so that wires carrying standing supplies cannot break off and short to sensitive parts of the circuit.

Note 1: For the purpose of this paragraph (12d(1)), a standing supply is defined as any power source, capable of initiating release, firing or jettison which is present at any time other than that of intended release, firing or jettison.

(2) When the aircraft independent armament power supplies (e.g., Busbar A and B) are used in the dispenser and control equipment then:

(a) Separate connectors shall be used for the independent power supplies or adequate isolation within a common connector shall be demonstrated.

(b) Interconnecting the supplies by diodes or semi-conductor devices shall be avoided.

(c) They shall not be controlled by two poles of common relay.

(d) The independent supply cable shall be loomed (insulated) separately and wherever possible, routed separately.

(e) When wafer switches are used, the supplies shall not be switched on the same wafer and a barrier of insulating material shall separate any adjacent wafers that control the independent supplies.

(f) Earths (grounds) from separated airframe earth points shall not be connected together.

(g) The dispenser electrical system shall be compatible with the aircraft power supply including voltage, current and transient effects.

(3) Relay coils and other coils, used in dc circuits, that produce transient energy when de-energized shall be fitted with suitable transient suppression.

e. The dispenser submunition ejection system should preferably require a continuous input signal for the entire ejection sequence, the termination of which may be accomplished by termination of the input signal. However, if this is not possible, one of the following requirements shall apply:

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(1) If a single pulse input signal is employed to initiate the dispenser ejection mechanism, then the duration of the pulse necessary to initiate the ejection sequence shall be sensibly longer than any possible transient pulses generated in or near the aircraft.

(2) If a system of digital coded pulses is employed to initiate the dispenser ejection mechanism, the signal shall be clear and unambiguous, and subject to repetition and cross-checking immediately prior to the commencement of the ejection phase.

f. Operation of the dispensing mechanism shall not occur unless an intentional command from the pilot or NAV/attack system has been received and:

(1) The dispenser has sensed directly that it is in a suitable environment to function and dispense its submunitions without hazarding the aircraft, or

(2) The aircraft has sensed that it is in a suitable environment to function the dispenser and dispense submunitions without hazarding the aircraft. The information can be passed directly to the dispenser system or be employed in the aircraft armament system to enable the aircraft to activate the dispenser power/command link.

g. Where it is an operational requirement to jettison a dispenser after use and the jettison maneuver and techniques are different for full, part-full or empty dispensers, then the dispensing system shall incorporate a feedback to the aircraft to indicate whether all submunitions have been dispensed. Such feedback shall also be provided where, after dispensing submunitions, the aircraft is required to land with the dispenser.

14. Submunition Cluster Fuzing (Where Applicable). Dispersion of submunitions from a submunition cluster shall be delayed, by inhibiting arming of the cluster fuzing system, until safe separation is assured. Submunition dispersal from the cluster shall require physical release of the cluster from the dispenser, followed by an input, in the correct sequence, provided by a defined free flight environment.

15. Aircraft Compatibility. The dispenser weapon, submunition cluster and submunition design shall provide for:

- a. Store geometry and strength conforming with STANAG 3441.
- b. Safe stability, control and flying qualities.
- c. Shipboard suitability of the aircraft with stores aboard, including storage compatibility of the store and ship, where required.
- d. Safe carriage, release and jettison characteristics.

e. The dispenser/aircraft electrical interface meeting the system electromagnetic compatibility requirements of applicable national documents as specified for the particular application.

f. Commonality for NATO usage being considered in the selection of control and release mechanisms, functioning sequence and connectors.

16. Safety - Environmental Effects

a. The system shall be designed to prevent accidental arming, functioning or damage that causes an unsafe condition to arise when it is exposed to specified natural and induced (including electromagnetic and electrostatic) environments.

b. Where applicable, the electromagnetic environments may include specified NEMP and/or lightning effects.

c. Electrical initiators shall require as high an operating energy for functioning as the system permits.

d. Confirmation that the weapon shall remain safe when subjected to the specified environments shall be demonstrated by testing.

17. Safe of Armed Condition

a. A dispenser weapon shall be so designed that:

(1) The submunition cannot be loaded into the dispenser in an unsafe condition, or inspection can check the safety condition of the submunition prior to, during and after loading into the dispenser.

(2) It cannot be assembled or installed on an aircraft in an unsafe condition, or inspection can check the safety condition during and after assembly as well as prior to, during and after installation on an aircraft.

b. There shall be an indicator or monitoring system fitted to give an unmistakable indication of the safety condition of the weapon particularly during unpackaged weapon handling and loading and aircraft standby operations.

18. Safety Assurance. A dispenser weapon shall incorporate design features to prevent the inadvertent occurrence of any event which could contribute to an unsafe condition. A dispenser weapon shall be so designed that:

a. No single credible circumstance can result in unintentional weapon arming.

b. Whenever possible, removal of safety constraints to permit dispenser function are controlled or powered by environmental forces present only in a correct and suitable dispenser functioning environment.

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IMPLEMENTATION OF THE AGREEMENT

19. This STANAG is implemented when a nation has issued instructions that all future equipment procured for its forces will be manufactured in accordance with the specifications detailed in this agreement.

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ANNEX A TO
STANAG 3786
(Edition 4)

GENERAL SAFETY DESIGN REQUIREMENTS GUIDANCE
FOR AIRBORNE DISPENSER WEAPONS

1. In observing the Design Safety Requirements and interpreting them for any particular application, the designer should know the design parameters for each dispenser weapon, including the conditions of storage and usage. Such details are normally included in the appropriate specification drawn up by specialist staff, after receipt of a Staff Requirement. There is, therefore, a need for general design guidance to aid the designer in this task.

DESIGN GUIDANCE

2. Design guidance includes concepts, logic, background, examples, statements of good practices or rules, time proven approaches or features, any of which can be used to aid the thought process of the designer in an effort to obtain optimum safety through design. For ease of application, the following guidance tracks by subject matter, the requirements of this STANAG.

3. Fuzing Safety. The intent of the fuzing requirements of STANAGs 3786 and 3525 is to assure the safety of the weapon through all phases of its life cycle up to the point of weapon/aircraft safe separation distance. The fuzing of a dispenser weapon usually comprises several "fuzes, " i.e., the dispenser fuze (for opening of a free flight dispenser) and the individual submunition fuzes. Captive dispensers do not contain a "fuze" per se but will contain adequate safety devices. These devices are designed not only to eject the weapon payload upon command, but also to prevent an inadvertent ejection of the weapon payload. In evaluating the safety of a dispenser weapon fuzing system, the entire fuzing system, i.e., the combined functioning of the dispenser, submunition cluster and submunition fuzing components should be considered. However, if it is intended to store or transport submunition clusters or submunitions outside the dispenser, adequate safety measures, including sensing of 2 environments, should be invested in that element of the fuzing system independent of the dispenser. Even if it is not intended to store or transport submunition clusters or submunitions outside the dispenser, the possibility of a submunition having to be removed or of it breaking free from the dispenser during an accident should be considered.

4. Dispenser Weapon Strength and Safety. In the structural design of the dispenser weapon, the maximum vibration, shock and acceleration forces the dispenser weapon may experience are an important consideration in achieving a safe design. Also the duration of these environments is important. For example, a captive dispenser designed for field reloading would experience much longer exposure to the aircraft induced flight environment.

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5. Strength and Compatibility of Materials. Materials used in the design of dispenser weapons should be capable of maintaining adequate strength since they can experience storage of extended periods. A reduction in material strength during storage can result in both safety and reliability problems. Compatibility of materials can be critical where moving parts or explosive compositions are involved. The stability of explosive compositions can be affected by both the aging process and compatibility with other materials.

6. Manual Operation. Where feasible, human actions which can affect dispenser weapon safety should be avoided. However, very few, if any designs can completely eliminate some requirement for manual (human) operations. Any critical manual operations should be extensively tested and analyzed by human engineering specialists.

7. Delivery Aircraft Safety. Properly designed fuzing for the dispenser, submunition cluster and submunition should provide for the basic safety of the delivery aircraft against premature warhead function. However, defining the requirements for the various fuzing subsystems requires a thorough understanding of the complete weapon system and the delivery aircraft.

8. Free-Flight Dispenser Weapons. The safe arming and functioning of a free-flight dispenser weapon is dependent upon the hazard of the dispersion event and the subsequent arming and functioning of the submunition clusters and/or submunitions. In addition to premature warhead functions, the hazard from collision of unarmed submunition clusters or submunitions with the delivery aircraft should be considered. This hazard is increased where forced dispersion is employed.

9. Captive Dispenser Weapons. Many captive dispensers do not contain a separate identifiable fuze system. Captive dispensers contain safety devices which control the ejection of the munition payload upon command and prevent inadvertent ejection of the munition payload. Captive dispenser weapon safety is heavily dependent upon the interface between the dispenser weapon and the delivery aircraft. One of the most difficult design challenges facing the captive dispenser weapon developer is safe jettison of the full, partially loaded, and empty dispenser. Extensive aerodynamic modeling and testing is necessary in evaluating the optimum payload dispensing sequence and the possible need for recyclable closures.

10. Submunition Cluster Fuzing. Where forceful dispersion of submunitions from submunition clusters is employed, simple and highly reliable methods of achieving submunition cluster fuze arming delay are recommended.

11. Aircraft Compatibility. The aircraft compatibility aspects of dispenser weapons are considerably more complex than for unitary weapons. This is particularly true where the dispenser may be utilized to deploy a variety of payloads. Each particular dispenser weapon (unique payload) development should include a comprehensive system safety study and analysis including aircraft compatibility issues.

12. Electromagnetic Effects and Electrostatic Discharges. The first step in determining the dispenser weapon's compatibility with the electromagnetic and electrostatic threats is definition of these environments normally included in the Staff Requirement. The second step includes a definition of the test environment, test procedure and instrumentation. The third step includes conducting the tests and analyzing the results. Depending upon the projected life cycle of the dispenser weapon, submunition cluster, and submunition, testing may be desirable at both the subsystem and system levels.

13. Safe or Armed Condition. For many submunitions, the requirement to determine the safe or armed condition after loading into the dispenser by inspection is extremely difficult to satisfy. Where submunitions deploy fins, retarders, stabilizers, etc., upon release from the dispenser, and this deployment is directly tied to fuze arming, the alternate requirement to prohibit loading an unsafe submunition into the dispenser is satisfied. The requirement of determining by inspection the safety arrangement of the dispenser weapon during and after assembly as well as prior to, during and after installation on the aircraft can usually be accomplished either by directly viewing the condition (safe/arm) of the fuze or through the use of a remote indication or monitoring system.

14. Safety Assurance. The achievement of the required safety assurance of a dispenser weapon involves a tradeoff between system safety, reliability, complexity and cost. In the design of dispenser weapons, particular attention should be placed on simple, robust design because of the multiple series events required to achieve reliable submunition function. Redundancy of safety critical functions is desirable where such redundancy does not impose unacceptable reliability or cost penalties. The evaluation of the safety assurance of a particular design will include extensive analysis (Failure Modes and Effects, Fault Tree, etc.).

RATIFICATION AND IMPLEMENTATION DETAILS
STADE DE RATIFICATION ET DE MISE EN APPLICATION

NATION	NATIONAL RATIFICATION REFERENCE DE LA RATIFICATION NATIONALE	NATIONAL IMPLEMENTING DOCUMENT NATIONAL DE MISE EN APPLICATION	IMPLEMENTATION/MISE EN APPLICATION					
			FORECAST DATE PREVUE			ACTUAL DATE REELLE		
			NAVY MER	ARMY TERRE	AIR	NAVY MER	ARMY TERRE	AIR
BE*	VS3 MAS/94/3005/1 of/du 29.6.94	STANAG						6.94
CA	2441-3786(DFTEM 4) of/du 1.12.93	See Overleaf/ Voir au verso				1.94		
DA	MA 204.68-S 3786/MAM 3-00111 of/du 4.1.94	STANAG						12.94
FR								
GE	BMVg-Fü S IV 2 Az 03-51-40 of/du 25.1.94		12.94	12.94	12.94			
GR	F.060/181745/HAFGS/D2/3 of/du 7.1.94	STANAG						9.95
IT								
LU	NOT PARTICIPATING/ NE PARTICIPE PAS							
NL	NW 94012577 of/du 17.2.94	STANAG					9.94	9.94
NO								
PO								
SP								
TU	GN.P.P:2307-122-94/AND.D. OF/du 31.1.94	DENSTANEM- 0714		7.97	3.94	1.89		
UK*	D/DPR(JS)/332/786/NMST of/du 15.4.94	STANAG				6.94	6.94	6.94
US								

See overleaf reservations(*)/comments (+)

Voir au verso réserves (*)/commentaires (+)

RESERVATIONS

- BE: Only valid for the acquisition of new equipment, not presently used by BAF.
- UK: The UK will use STANAG 4187 instead of STANAG 3525 to define the fuze safety requirements of paragraph 5 of the agreement.

RESERVES

- BE: Valable uniquement pour l'acquisition de nouveaux matériels non encore utilisés par la BAF.
- UK: Le Royaume-Uni utilisera le STANAG 4187 au lieu du STANAG 3525 pour définir les principes de sécurité des fusées du paragraphe 5 de l'accord.

NATIONAL IMPLEMENTING DOCUMENTS/
DOCUMENTS NATIONAUX DE MISE EN APPLICATION

- CA: NDHQ Master Listing for International Programmes Vol II